

**Abstract of the Invention**

The present invention provides for an apparatus and method to manufacture optical fiber in a way that produces controlled and patterned diffusion of optical radiation along its length. The novelty of the described invention is that the patterns of diffusion are produced at the time the optical fiber is manufactured. The "in-line" manufacturing method avoids the need for post-production treatment of the fiber, which makes the process highly efficient and economical. Light diffusing optical fibers of significant length can be produced. Several manufacturing configurations to achieve the desired effects and their inclusion in the fiber production process are described. The processes can be configured to process optical fibers constructed from a wide variety of known glass, polymeric or other materials. The partially diffusing optical fibers of this invention have applications ranging from illuminated fabrics and toys and to lighting systems and medical instruments. A distributed sensor comprising a light detector coupled to a partially diffusing fiber is also disclosed.